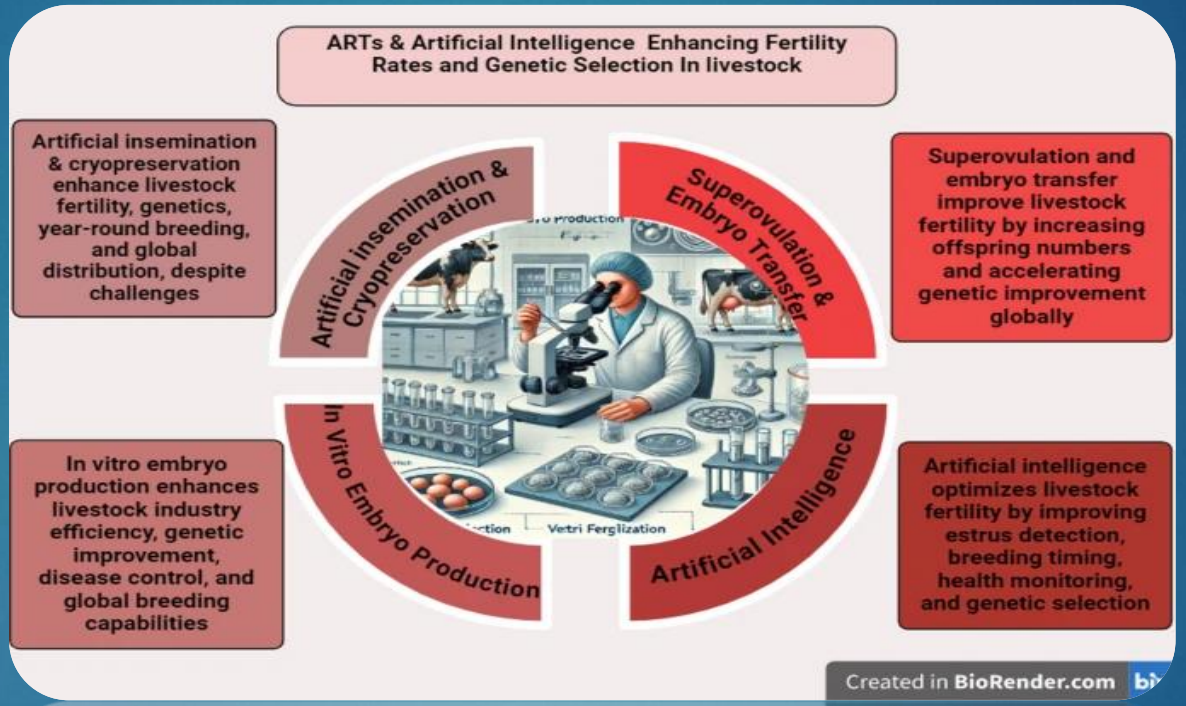
ASSISTED REPRODUCTIVE TECHNOLOGIES IN VETERINARY MEDICINE



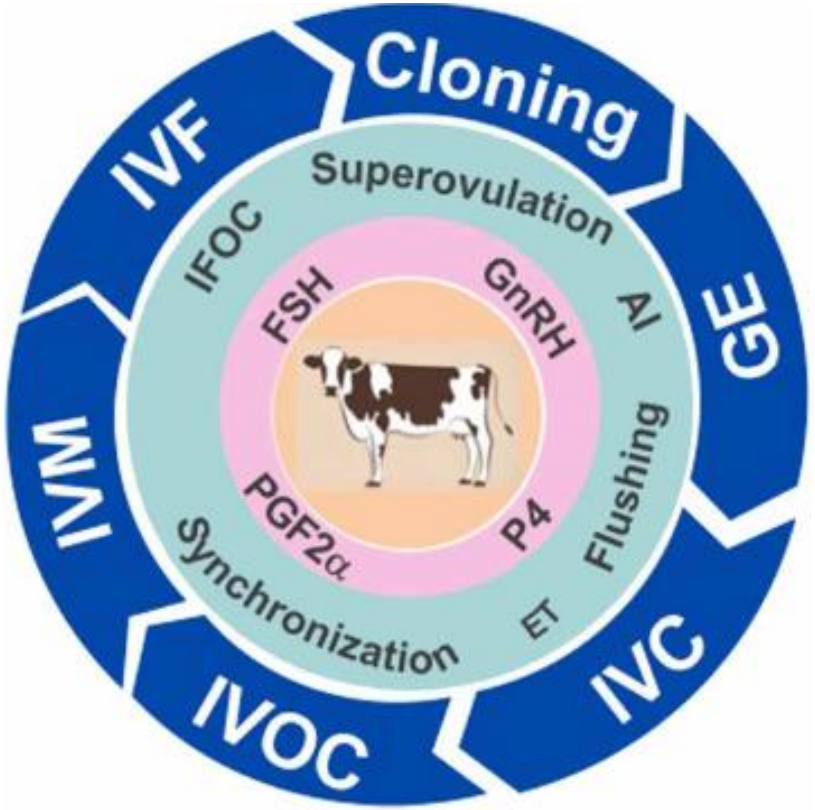
جامعة الإخوة منتوري قسنطينة
UNIVERSITE DES FRERES MENTOURI CONSTANTINE

THERIOGENOLOGY LECTURES – A5

Prof. Sana HIRECHE

CONCENTRIC CIRCULAR DIAGRAM OF REPRODUCTIVE TECHNOLOGIES EMPLOYED IN DAIRY CATTLE BREEDING PROGRAMS

The outermost circle of interlocking chevrons (navy) lists laboratory based *in vitro* reproductive technologies used to develop and mature female gametes (IVOC & IVM) and normal and genetically modified embryos (IVF & IVC and Cloning & GE) for transfer into recipient animals

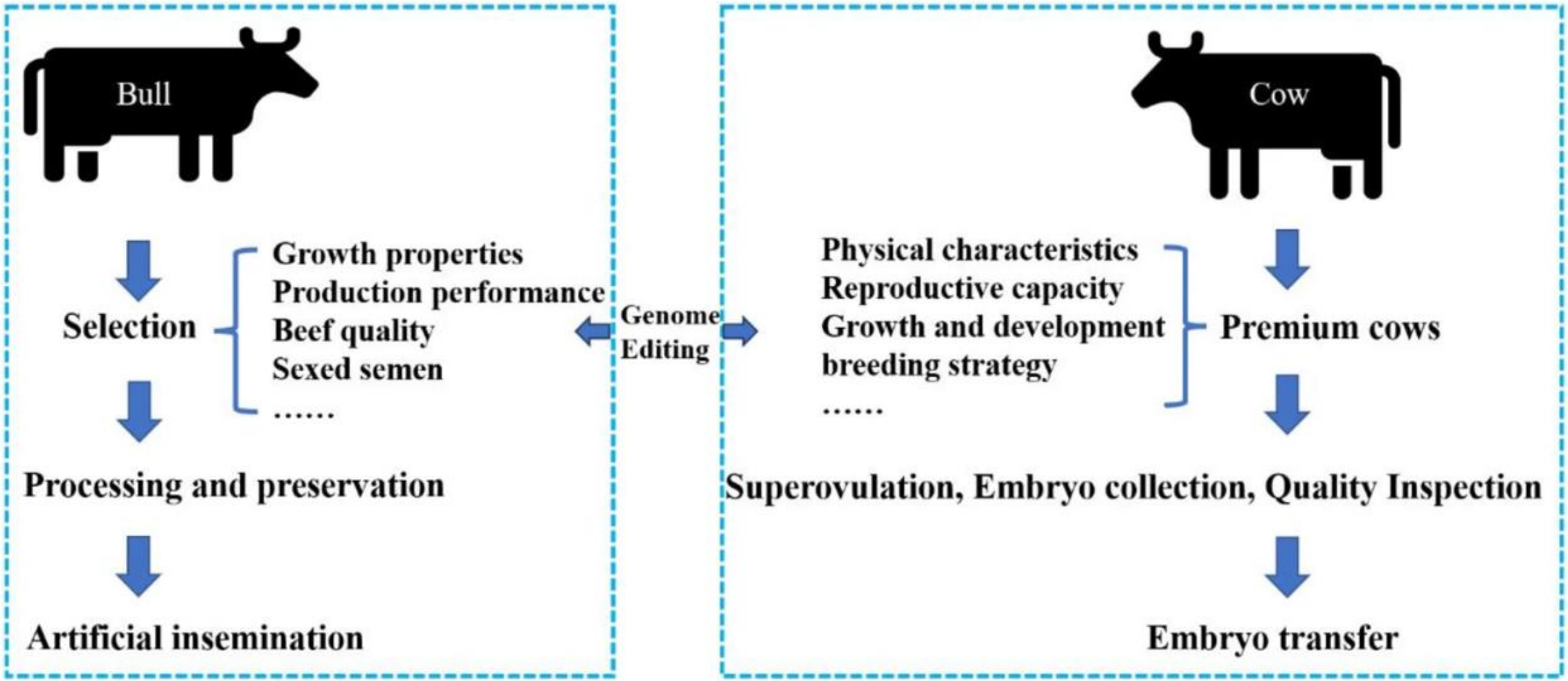


The middle circle (jade) lists technologies/interventions used to recover immature (OPU) and generate mature oocytes (superovulation, IFOC) and embryos (AI and Flushing) for subsequent embryo recovery and embryo transfer (ET) to recipient animals

Innermost circle (pink) lists the principal hormones involved in the manipulation of follicle development and the estrous cycles of donor and recipient animals

Created by Prof. Sana HIRECHE

From: Retrospect and prospect: reproductive technologies in beef cattle



Reproductive technology

REPRODUCTIVE BIOTECHNOLOGIES

- **Artificial insemination (AI)** is by far the most widely used reproductive biotechnology for breeding cattle
- Estimates of the number of **AIs** performed in cattle are difficult to pinpoint because of differences in the way such figures are reported

REPRODUCTIVE BIOTECHNOLOGIES

- In 1999, **264 million bull semen doses** were produced worldwide (Thibier and Wagner 2002)
- This figure has more than doubled in the last 20 years since the annual production of **cattle and buffalo semen doses** in **India alone is now 115 million**

Dairy cattle production at ICAR-National Dairy Research Institute, India (Yatta et al 2022)

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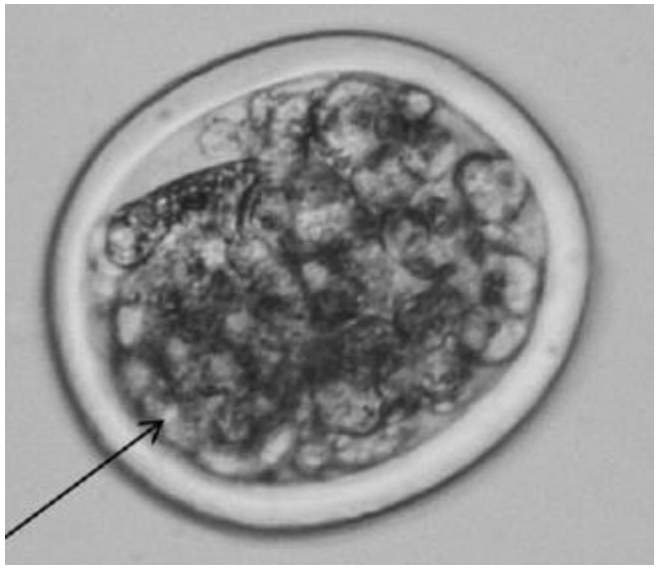
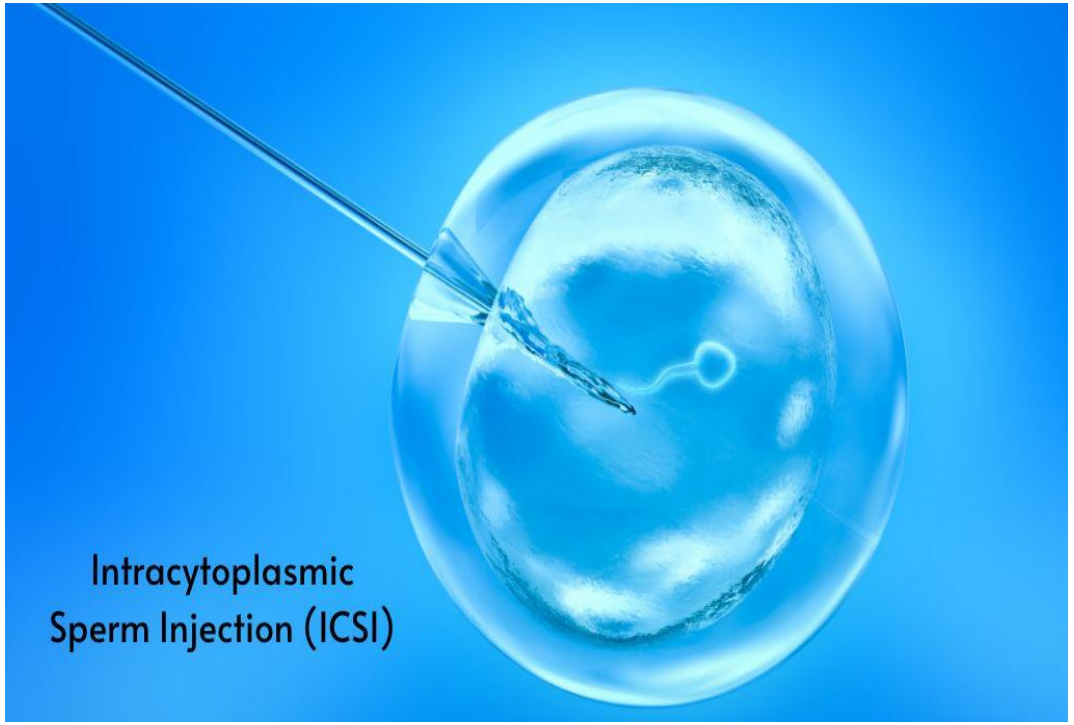
REPRODUCTIVE BIOTECHNOLOGIES

- **Embryo transfer** is the second most widely used **ART**, but accounts for a much smaller proportion of the animals bred than **AI**.
- In **2019**, almost **1.5 million transferrable embryos** were produced (Viana, 2019).
- The embryos used are either derived **in vivo** or may be produced **in vitro** in some countries.



REPRODUCTIVE BIOTECHNOLOGIES

- Another reproductive biotechnology, **intra cytoplasmic sperm injection (ICSI) of bovine oocytes**, is possible (Magata et al. 2019) but is not performed routinely.

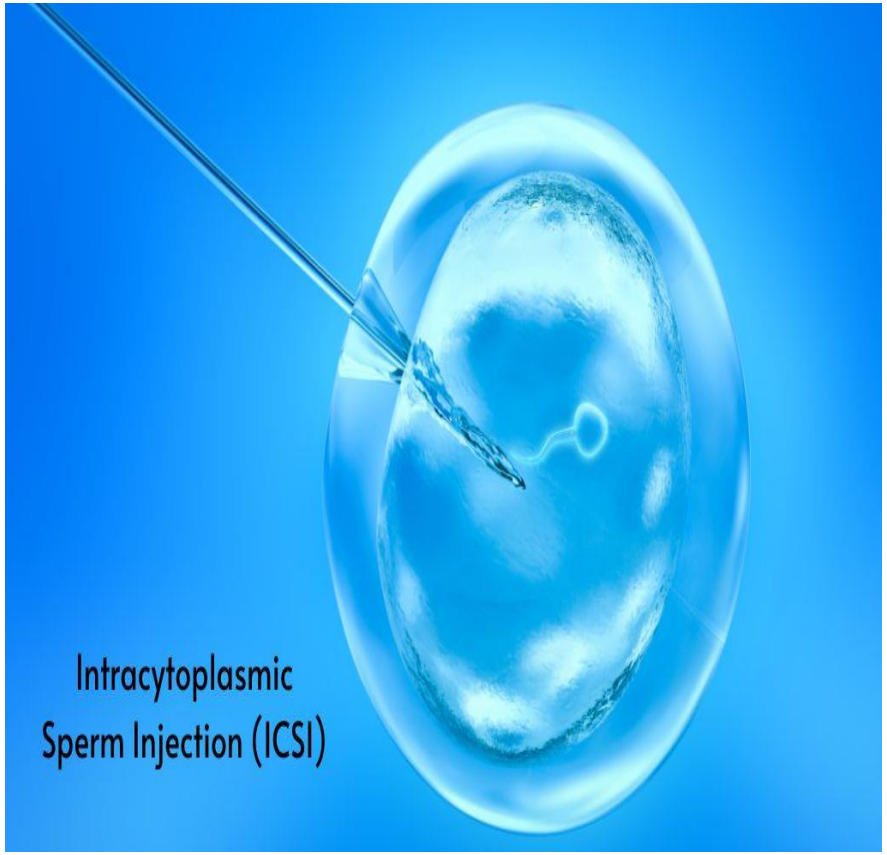


REPRODUCTIVE BIOTECHNOLOGIES

- There are problems with the technique in cattle :
  - The dark ooplasm, making visualization of the internal structures of the oocyte difficult (Wei and Fukui 2020)
  - The large head of bull spermatozoa (Galli et al. 2003)
  - The lack of oocyte activation

REPRODUCTIVE BIOTECHNOLOGIES

- **These technical difficulties** result in **low efficiency of the technique in cattle** (Unnikrishnan et al. 2021).



REPRODUCTIVE BIOTECHNOLOGIES

Two calves were derived from ICSI embryos using vitrified OPU oocytes

Left : A female calf whose body weight was 33.0 kg, was born 278 days after embryo transfer.
Right : A male calf whose body weight was 29.3 kg, was born 288 days after embryo transfer (Kagawa et al 2022).

REPRODUCTIVE BIOTECHNOLOGIES

- Embryo production in vitro **(IVP)** and **ICSI** have their **own specific requirements for sperm preparation.**

REPRODUCTIVE BIOTECHNOLOGIES

- The expanding use of AI and outstanding proven sires contributed to :
  - **Enhance production potentials**,
  - **Control genital diseases transmitted through natural service**,
  - **Aid in animal improvement**